



INVESTIGATOR'S ANNUAL REPORT

United States Department of the Interior

National Park Service

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Reporting Year: 2008	Park: Glacier Bay NP & PRES	Select the type of permit this report addresses: Scientific Study	
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Study Title (maximum 300 characters): Scale and distribution of global pollutants (mercury and POPs)in Southeast Alaska Network park watersheds			
Park-assigned Study or Activity #: GLBA-00111	Park-assigned Permit #: GLBA-2007-SCI-0012	Permit Start Date: Jun 15, 2007	Permit Expiration Date: Mar 31, 2008
Scientific Study Starting Date: Jun 15, 2007		Estimated Scientific Study Ending Date: Mar 31, 2008	
For either a Scientific Study or a Science Education Activity, the status is: Completed		For a Scientific Study that is completed, please check each of the following that applies: <input checked="" type="checkbox"/> A final report has been provided to the park or will be provided to the park within the next two years <input type="checkbox"/> Copies of field notes, data files, photos, or other study records, as agreed, have been provided to the park <input type="checkbox"/> All collected and retained specimens have been cataloged into the NPS catalog system and NPS has processed loan agreements as needed	
Activity Type: Research			
Subject/Discipline: Contaminants / Hazardous Materials			

Purpose of Scientific Study or Science Education Activity during the reporting year (maximum 4000 characters):

The main goal of this project is to conduct a contaminants survey in freshwater fish, benthic macroinvertebrates (BMI), streambed sediments, and stream water in a variety of watersheds in Glacier Bay National Park and Preserve (GLBA). The harmful effects of mercury (Hg) and persistent organic pollutants (POPs) in the environment is well established. However, there is scarce information on these pollutants in southeast Alaska, although the limited data indicate they may be present at high concentrations (Day et al., 2004; Fitzgerald et al., 2006; Vander Pol et al., 2004). While local emission sources are insignificant, global sources of Hg and some forms of POPs are projected to continue rising. In particular, the rapid economic expansion of China, whose energy needs are being met by extensive Hg-laced coal burning, is suspected to be leading to large increases in Hg export to Alaska via atmospheric transport

pathways (Streets et al., 2005). Both Hg and POPs are highly volatile and tend to become concentrated at high latitudes due to atmospheric circulation patterns and polar temperature controls (AMAP, 2002; Pacyna and Pacyna, 2002). In addition, salmon and birds may act as powerful biovectors of these contaminants; accumulating them in oceans and distant source areas and depositing them in riparian areas as they pass through to spawn or migrate (Blais et al., 2007). This project would provide original data that would evaluate the current scale of these contaminants in GLBA freshwater streams, examine the landscape patterns that explain their distribution, and also pertain to the Vital Signs program by serving as a baseline data set to which future contaminants monitoring can be compared.

Findings and status of Scientific Study or accomplishments of Science Education Activity during the reporting year (maximum 4000 characters):

The highest concentrations of filtered total mercury (HgT) were found in the two old (not recently glaciated), peatland-rich watersheds from Pleasant Island (adjacent to GLBA), where values were ~10-fold higher than in GLBA, SITK, and KLGO. Filtered methylmercury (MeHg) was low in all of the newer, recently glaciated streams in GLBA, compared with several of the medium- and old-aged GLBA-area streams draining landscapes with developed peatlands (comprising up to 21% of the total mercury). The microbial conversion of inorganic Hg to MeHg is known to depend greatly on the prevalence of organic-rich peatlands, which are more common in older watersheds in southeast Alaska. The concentration of HgT in water was strongly correlated with the mapped percent of the watershed covered by wetlands and with the concentration of dissolved organic carbon (in particular the hydrophobic fraction, which increases with runoff from wetlands). Spatial patterns of methylmercury concentrations in resident mayflies and juvenile coho, combined with comparisons of Hg concentrations in precipitation, indicate that in older watersheds, the amount of Hg released via streamwaters is roughly equivalent to that in wet deposition and that a fraction of it is converted to MeHg, which is taken up in the food web. Limited data on older coho fry indicate bioaccumulation taking place within the fish.

Stratification of the study streams by age group (young, <100 years; medium, 100-200 years; and old, >1000 years) reveals that mercury concentrations in GLBA streams systematically increases as watersheds age. Mercury increased from the young to medium to old groups for filtered water (HgT and MeHg), streamwater particulates (HgT), both groups of mayflies (HgT and MeHg), and the juvenile coho salmon. Our data also show that in general, the older the watershed, the lower the stream pH and dissolved solid concentrations (sulfate, Ca, Mg, and Si), and the higher the DOC and Cl concentrations. No age-related patterns were found for the persistent organic pollutants in fish.

Concentrations of HgT in streamwater were 3-4 orders of magnitude below EPA levels of concern for human health or for aquatic organisms. Mercury in age 0+ juvenile coho easily met standards set by the USEPA's National Fish Tissue Survey for the protection of piscivorous birds and mammals that consume them (100 ng/g). However, samples of age 1+ coho were as high as 80 ng/g, which closely approaches the criterion and more than doubles the reported values for adult coho. Streambed sediment concentrations of mercury were all below the national median value of 60 ng/g (dry weight), and well below for probable effect levels. Mercury concentrations in mayflies and juvenile coho were generally on the low end to midrange values of samples reported for elsewhere in the nation.

Of the 77 POPs analyzed in the juvenile coho samples, most were below quantification limits, notably both current-use pesticides (endosulfen I and lindane) and all HCHs, PBDEs, aldrin, and mirex. Yet, quantifiable HCB, chlordanes, dieldrins, several congeners of PCBs, DDE, and DDT were found in at least some samples. DDTs and PCBs were detectable in fish from all streams except one. Gull Creek stands out in that its coho samples had the highest number of different types of POPs, perhaps due to contributions by spawning salmon carcasses in this particularly productive stream. Most of the detected POPs compounds have been banned for over 30 years, but they and some of their breakdown products continue to occur in organisms in remote areas such as in southeast Alaska, albeit at levels below environmental and human-health concerns.

For Scientific Studies (not Science Education Activities), were any specimens collected and removed from the park but not destroyed during analysis?

No

Funding specifically used in this park this reporting year that was provided by NPS (enter dollar amount):

\$0.00

Funding specifically used in this park this reporting year that was provided by all other sources (enter dollar amount):

\$0.00

List any other U.S. Government Agencies supporting this study or activity and the funding each provided this reporting year:

For Scientific Studies (not Science Education Activities), were any specimens collected and removed from the park but not destroyed during analysis?

No

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